



Harbor, Haynes and Scattergood Generating Stations – Review of Preliminary Results and Target Taxa

Prepared for:
California Regional Water
Quality Control Board – Los
Angeles Region
May 7, 2007

Agenda

1. Introductions
2. Review of Impingement and Entrainment Characterization Study Plan
3. Review of IM&E Data and Analyses



2006 Impingement Sampling

- Normal Operation Frequency
 - Weekly (Scattergood, Harbor, Haynes, and Alamitos)
 - Monthly (El Segundo and Redondo Beach)
- Heat Treatment/Marine Growth Control
 - Scattergood, El Segundo, Haynes, and Redondo Beach

Impingement Sampling

- Sampled entire 24 hour period – (four 6-hour cycles)
- All fish and invertebrates identified
- All fishes and following shellfish counted and measured: rock crabs, shrimp, octopus, squid, and California spiny lobster
- Quarterly QA/QC of field sampling to verify compliance with written procedures



Traveling Screens -
Scattergood, El Segundo,
Redondo Beach, Haynes, and
Alamitos

**Slide Screens - Haynes Units
1&2**



2006 Entrainment Sampling

- Entrainment Sampling Frequency
 - Biweekly (Scattergood, Redondo Beach, Harbor, Haynes, and Alamitos)
 - Monthly (El Segundo)
- Source Water Sampling Frequency
 - Monthly (All Facilities)

Entrainment Sampling

- Sampled entire 24 hour period –(four 6-hour cycles)
- Sampled with 333 micron mesh net. Samples labeled and preserved, then sorted in the laboratory
- Fish eggs and larvae and selected invertebrate larvae removed from samples, then identified, counted and measured
- Selected shellfish
 - all crab megalops
 - market squid hatchlings
 - California spiny lobster phyllosome larvae
- QA/QC: Quarterly for field sampling and ongoing for laboratory processing

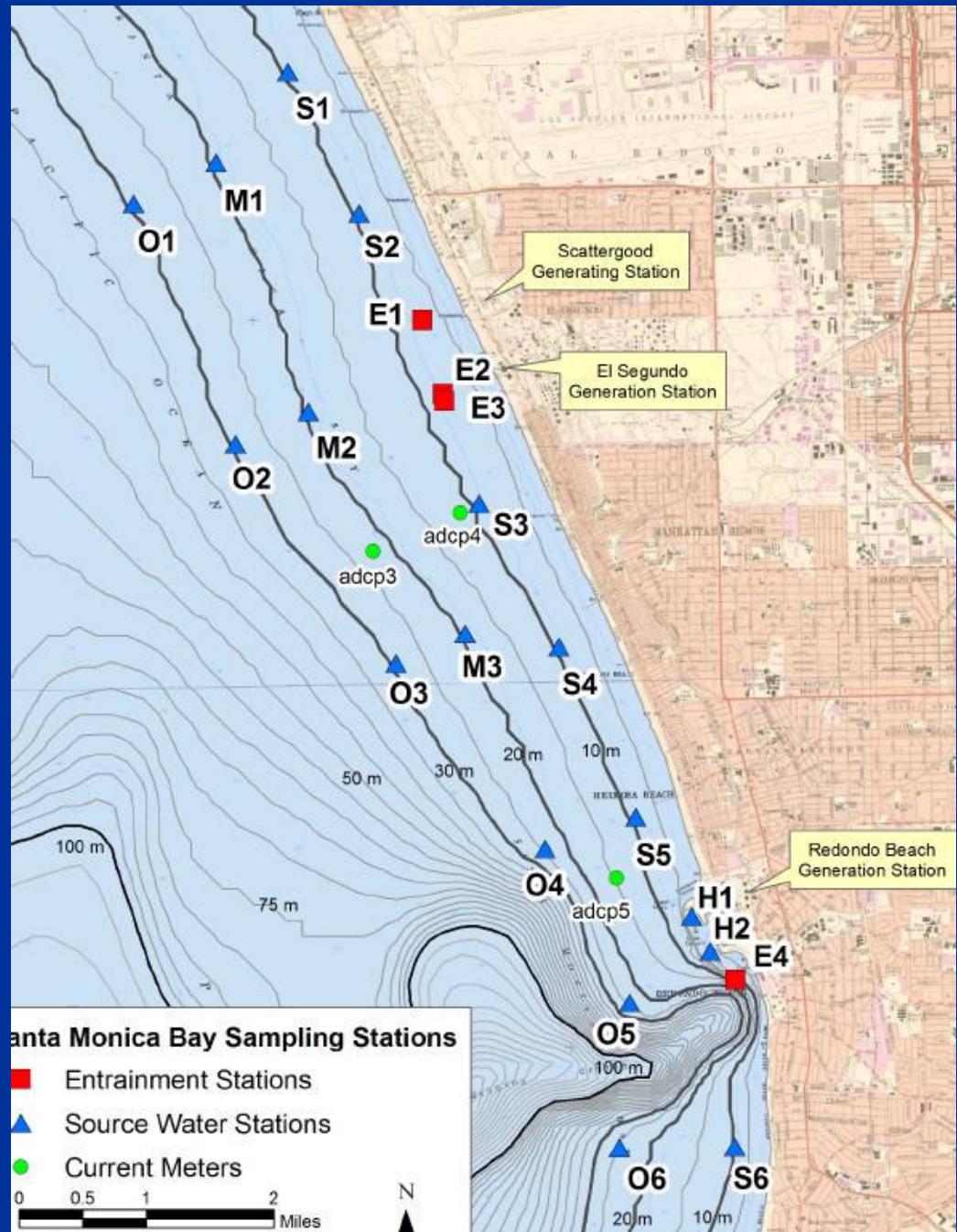
Bongo Net Sampling



Power Plant Locations



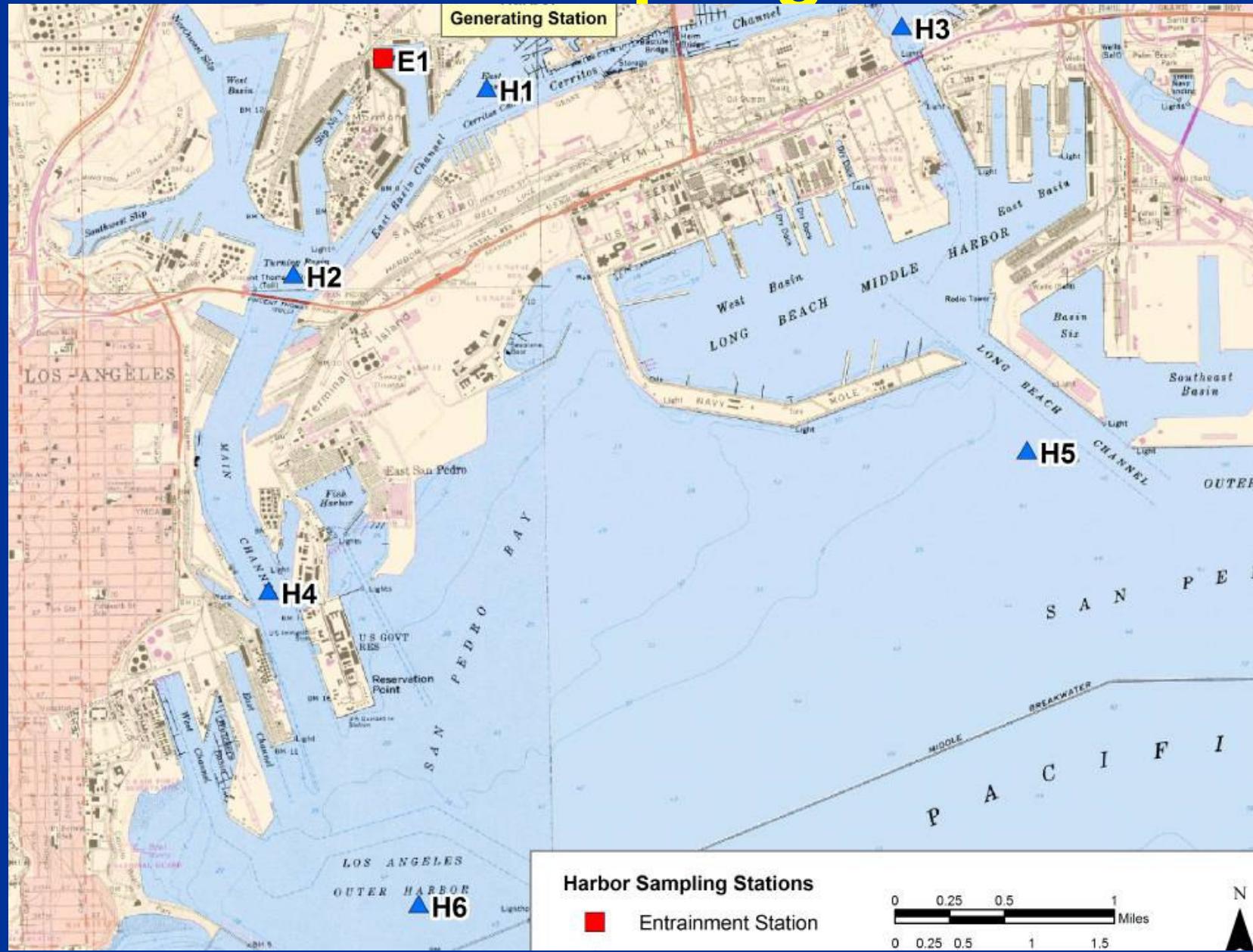
Santa Monica Bay Sampling Locations – SGS, ESGS, RBGS



Alamitos Bay Sampling Locations – Haynes and Alamitos GS



Harbor GS Sampling Locations



Species Proposed for Assessment

Proposed Fish Taxa for Impingement Analysis

Taxon	Common name	<u>SGS</u>	<u>ESGS</u>	<u>RBGS</u>	<u>HGS</u>	<u>AGS</u>	<u>HnGS</u>
FISHES							
<i>Acanthogobius flavimanus</i>	yellowfin goby				X		
<i>Atherinops affinis</i>	topsmelt	X				X	X
<i>Atherinopsidae</i>	silverside, unid.					X	
<i>Atherinopsis californiensis</i>	jacksmelt	X	X				
<i>Brachystius frenatus</i>	kelp perch			X			
<i>Cheilotrema saturnum</i>	black croaker	X	X				
<i>Chromis punctipinnis</i>	blacksmith	X	X				
<i>Cymatogaster aggregata</i>	shiner perch	X	X		X	X	X
<i>Embiotoca jacksoni</i>	black perch	X	X		X		
<i>Engraulis mordax</i>	northern anchovy	X	X	X		X	X
<i>Genyonemus lineatus</i>	white croaker	X					X
<i>Gibbonsia elegans</i>	spotted kelpfish				X		
<i>Halichoeres semicinctus</i>	rock wrasse			X			
<i>Heterostichus rostratus</i>	giant kelpfish				X		
<i>Hyperprosopon argenteum</i>	walleye surfperch	X	X	X			
<i>Hypsurus caryi</i>	rainbow seaperch			X			
<i>Leptocottus armatus</i>	Pacific staghorn sculpin					X	
<i>Myliobatis californica</i>	bat ray		X				
<i>Oxyjulis californica</i>	senorita			X			
<i>Paralabrax clathratus</i>	kelp bass		X	X			
<i>Paralabrax nebulifer</i>	barred sand bass	X		X		X	
<i>Phanerodon furcatus</i>	white seaperch		X	X			
<i>Porichthys myriaster</i>	specklefin midshipman					X	
<i>Rhacochilus toxotes</i>	rubberlip seaperch		X	X			
<i>Rhacochilus vacca</i>	pile perch		X	X			
<i>Sardinops sagax</i>	Pacific sardine	X					
<i>Scorpaena guttata</i>	California scorpionfish		X	X			
<i>Sebastes auriculatus</i>	brown rockfish			X			
<i>Seriphis politus</i>	queenfish	X	X	X		X	X
<i>Syngnathus leptorhynchus</i>	bay pipefish						X
<i>Syngnathus</i> spp.	pipefish, unid.						X
<i>Urobatis halleri</i>	round stingray			X	X		

Proposed Shellfish Taxa for Impingement Analysis

		<u>SGS</u>	<u>ESGS</u>	<u>RBGS</u>	<u>HGS</u>	<u>AGS</u>	<u>HnGS</u>
<i>Aplysia californica</i>	California seahare					X	X
<i>Cancer antennarius</i>	Pacific rock crab	X	X	X			
<i>Cancer anthonyi</i>	yellow crab	X	X	X			
<i>Cancer jordani</i>	hairy rock crab	X					
<i>Cancer productus</i>	red rock crab	X					
<i>Cancer</i> spp.	cancer crab, unid.				X		
<i>Loligo opalescens</i>	California market squid	X					X
<i>Loxorhynchus grandis</i>	sheep crab	X		X			
<i>Octopus bimaculatus/bimaculoides</i>	California two-spot octopus	X		X	X	X	X
<i>Panulirus interruptus</i>	California spiny lobster	X	X	X	X		

Changes to Impingement Taxa

- Scattergood Generating Station
 - barred sand bass not analyzed
 - cancer crabs included
- El Segundo Generating Station
 - market squid included
- Redondo Beach Generating Station
 - kelp perch and cancer crabs not analyzed
 - market squid included

Changes to Impingement Taxa (continued)

- Harbor Generating Station
 - yellowfin goby and spotted kelpfish not analyzed
- Alamitos Generating Station
 - northern anchovy not analyzed
 - octopus not analyzed
- Haynes Generating Station
 - white croaker not analyzed
 - specklefin midshipman and market squid included

Proposed Fish Taxa for Entrainment Analysis

Taxon	Common name	<u>SGS</u>	<u>ESGS</u>	<u>RBGS</u>	<u>HGS</u>	<u>AGS</u>	<u>HnGS</u>
<i>Acanthogobius flavimanus</i>	yellowfin goby				X		
<i>Atherinopsidae</i>	silversides	X	X	X		X	X
<i>CIQ Gobiidae unid.</i>	gobies	X	X	X	X	X	X
<i>Citharichthys spp.</i>	sanddabs	X	X				
<i>Engraulidae</i>	anchovies	X	X	X	X	X	X
<i>Genyonemus lineatus</i>	white croaker	X	X	X	X		X
<i>Gibbonsia</i> spp.	clinid kelpfishes				X		
<i>Gobiesox</i> spp.	clingfishes				X		
<i>Hypsoblennius</i> spp.	blennies	X	X	X	X	X	X
<i>Hypsopsetta guttulata</i>	diamond turbot	X	X				
<i>Hypsoprops runbicus</i>	garibaldi				X		
<i>Labrisomidae unid.</i>	labrisomid kelpfishes				X		
<i>Lepidogobius lepidus</i>	bay goby					X	
<i>Oxyjulis californica</i>	senorita	X					
<i>Paralabrax</i> spp.	sand bass	X	X	X			
<i>Paralichthys californicus</i>	California halibut	X	X	X			
<i>Parophrys vetulus</i>	English sole		X	X			
<i>Pleuronichthys ritteri</i>	spotted turbot	X					
<i>Sciaenidae unid.</i>	croaker	X	X	X		X	
<i>Seriphis politus</i>	queenfish	X	X	X			
<i>Sphyraena argentea</i>	California barracuda	X					
<i>Typhlogobius californiensis</i>	blind goby				X		

Proposed Shellfish Taxa for Entrainment Analysis

		<u>SGS</u>	<u>ESGS</u>	<u>RBGS</u>	<u>HGS</u>	<u>AGS</u>	<u>HnGS</u>
<i>Cancer anthonyi</i>	yellow rock crab	X					
<i>Loligo opalescens</i>	market squid	X					
<i>Panularis interruptus</i>	California spiny lobster				X		

Changes to Entrainment Taxa

- Scattergood Generating Station
 - English sole included
 - *C. anthonyi* combined with other cancer crab larvae
- El Segundo Generating Station
 - cancer crabs included
- Redondo Beach Generating Station
 - English sole not included
 - analysis not completed for spiny lobster

Changes to Entrainment Taxa (continued)

- Harbor Generating Station
 - none
- Alamitos Generating Station
 - none
- Haynes Generating Station
 - none

Impingement Analyses

- Annual estimates of total impingement for all fishes and shellfishes collected
- Analysis approaches:
 - Annual estimates used to extrapolate to adult fish (age-1) losses in numbers (AEL) or biomass (PF) – limited by availability of life history information
 - Compare extrapolated losses with recreational and commercial catch data

Entrainment Analyses

- Annual estimates of total entrainment for all fishes and shellfishes processed from samples
- Analysis approaches:
 - Annual estimates used to extrapolate to adults fish losses losses in numbers (AEL, FH) or biomass (PF) – limited by availability of life history information
 - Compare extrapolated losses with recreational and commercial catch data

Entrainment Analyses (continued)

- Combine entrainment and source water population estimates in ETM to estimate mortality due to entrainment.
- Use ETM to calculate effects on recreational and commercial catch assuming no compensation
- Calculate estimates of Area of Production Foregone (APF) where appropriate
- Compare results across models where possible

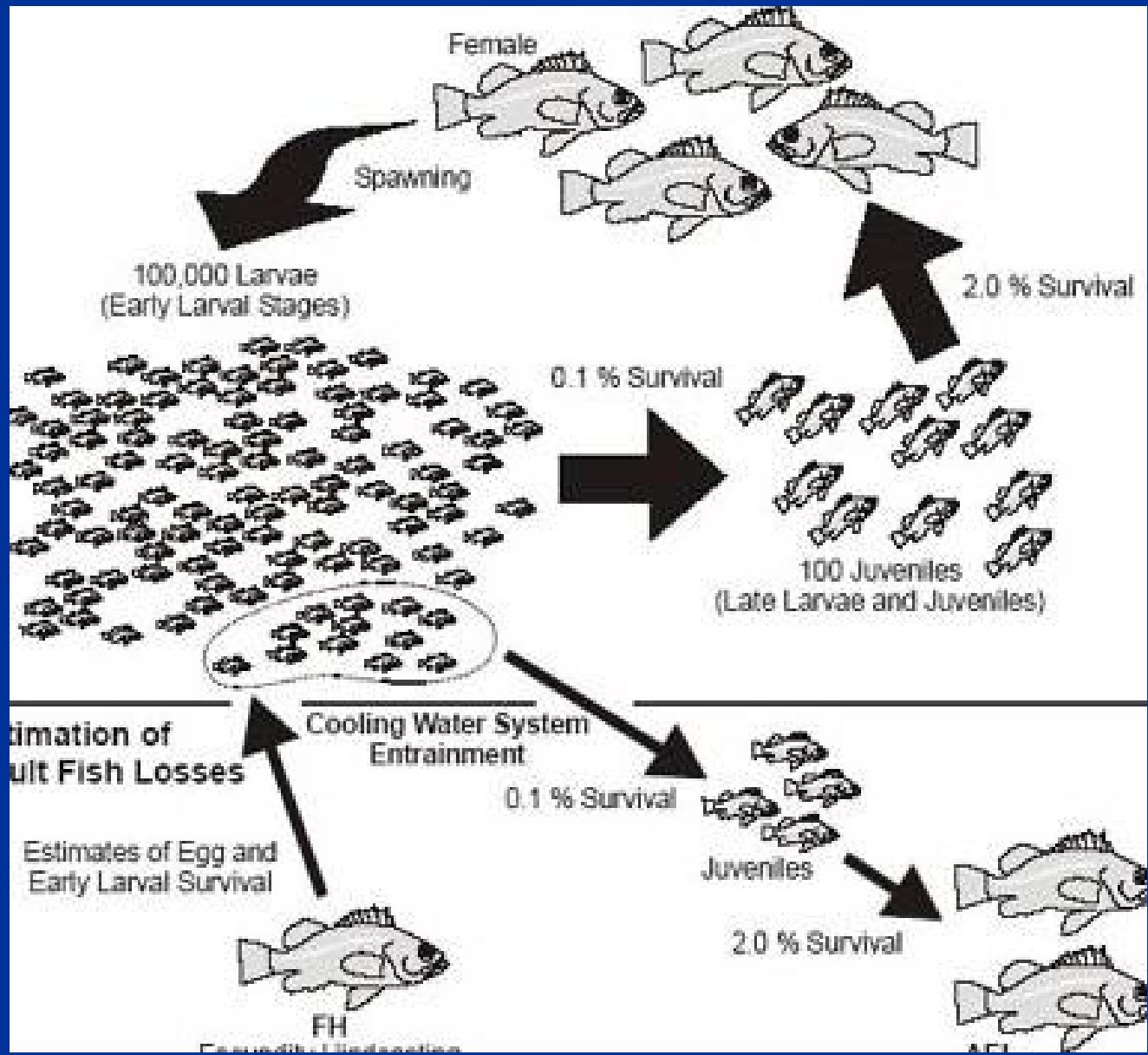
Assessment Models

- **Demographic Models – IM&E**
 - Adult Equivalent Loss (AEL)
 - Fecundity Hindcasting (FH)
 - Production Foregone
- **Conditional Mortality Models – only E**
 - Empirical Transport Model (ETM)

Demographic Models

Data Required

- fecundity
- age at maturity
- longevity
- survival data – eggs, larvae, other stages



Demographic Model Fecundity Hindcasting

$$FH = \frac{\text{Entrainment}_{Total}}{\prod_{j=1}^n \text{Survival}_j \bullet \text{Fecundity}_{Total}}$$

$$\text{Fecundity}_{Total} = \overline{\text{Eggs} / \text{year}} \bullet \left(\frac{\text{Longevity} - \text{Maturation}}{2} \right)$$

Fecundity Hindcasting KGB Rockfishes

- Adjusted Annual Entrainment = 275,000,000
- Average Annual Fecundity = 215,000
- Longevity = 15 yr
- Maturation = 5 yr
- Larval Survival – instantaneous daily mortality rate of 0.14 d^{-1} for blue rockfish = 0.419
- Larval growth rate of 0.14 d^{-1} for brown rockfish – to estimate larval duration

Fecundity Hindcasting KGB Rockfishes

$$FH = 617 = \frac{275,000,000}{1.0 \bullet 1.0 \bullet 0.419 \bullet 213,000 \bullet \frac{(15 - 5)}{2}}$$

egg survival yolk-sac survival

Demographic Model Adult Equivalent Loss

$$AEL = (\text{Entrainment}_{total}) \\ (S_{Early Larvae}) (S_{Late Larvae}) (S_{Early Juv.}) (S_{Late Juv.}) (S_{Pre-Recruits})$$

Demographic Model Adult Equivalent Loss

$$AEL = 1,120 = (275,000,000) \\ (0.145) (0.0408) (0.00823) (0.125) (0.670)$$

Entrainment Assessment

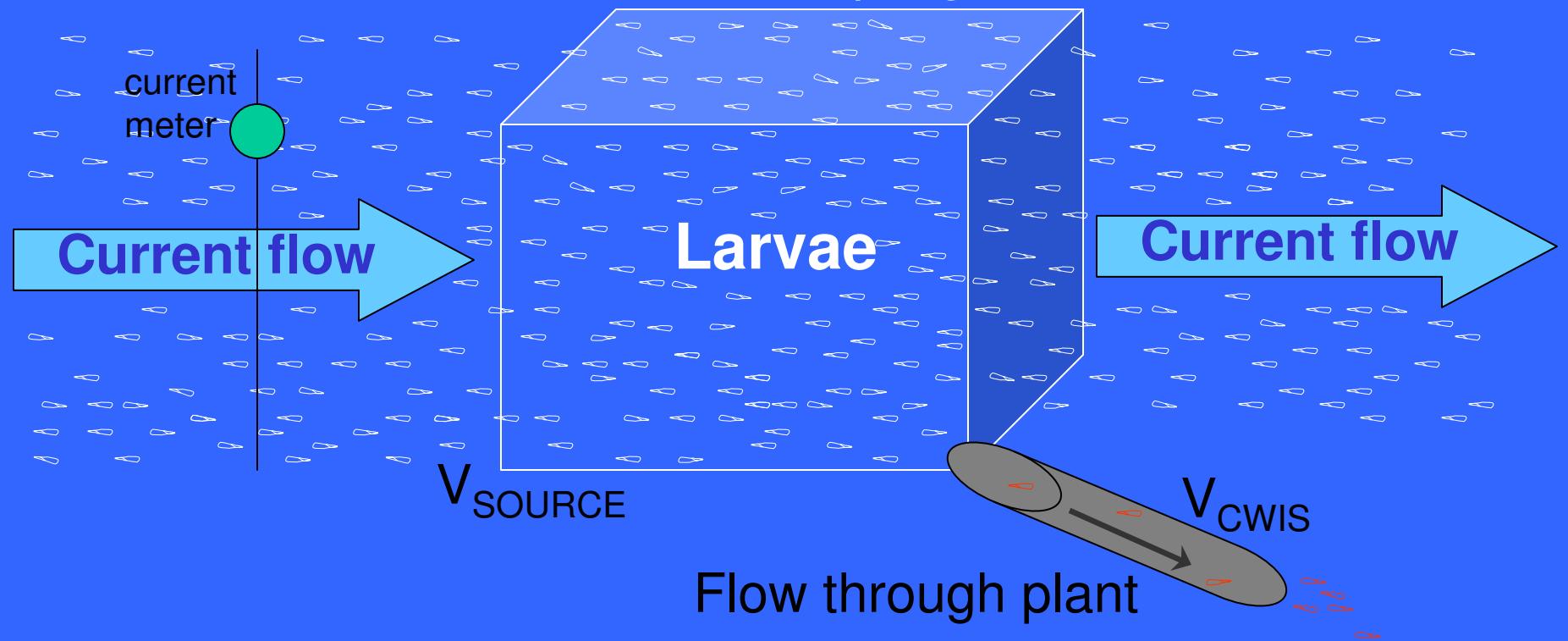
Demographic Models

- Only calculated for a limited number of fishes due to absence of reliable life history information – could be expanded by making numerous assumptions
- Only *FH* estimate calculated for fish eggs – far fewer assumptions than AEL that would involve extrapolating across larval and juvenile stages to adult

Entrainment

Conceptualization of *ETM*

Nearshore Sampling Area



Conditional mortality due

to entrainment =

$$\frac{\rho_{\text{Entrainment}} \cdot V_{\text{CWIS}}}{\rho_{\text{SourceWater}} \cdot V_{\text{SOURCE}}}$$

Empirical Transport Model

- Only life history information is larval growth rate to estimate duration

$$P_M = 1 - \sum_{i=1}^n f_i (1 - PE \bullet P_S)^{days}$$

- P_s = ratio of area, volume, or number sampled to the larger population of inference – proportion of parental stock

Empirical Transport Model

- Model varied based on source water characteristics at each plant
- Harbor GS – fixed source water (no P_S)
- Scattergood and El Segundo GS – alongshore and onshore currents used to extrapolate source water (P_S varied by larval duration)
- Redondo Beach GS – fixed source water component (King Harbor) and nearshore component estimated using alongshore currents
- Haynes and Alamitos GS - fixed source water component (Alamitos Bay), tidal exchange with nearshore component that was estimated using alongshore and onshore currents

Scattergood GS

Entrainment Analysis Results

Taxon	Common Name	Entrainment	Total Average Entrainment	Total Average Source Water	Fecundity			Alongshore Distance (km) used in Source Water	Offshore Distance (km) used in Source Water
			Estimated 2006	Station Concentration (#/1000m ³)	Station Concentration (#/1000m ³)	Hindcast Estimate - Females	Adult Equivalent Model Estimate	ETM Proportional Mortality Estimate (P_M) ¹	
FISHES									
Engraulidae unid.	anchovies	44,584,991	114.17	167.95	16,273	32,845	0.0019	54.6	21.7
Sciaenidae unid.	croakers	42,076,568	91.87	36.15			0.0064	28.5	7.4
<i>Paralabrax</i> spp.	sand bass	29,681,768	61.48	38.17			0.0017	21.9	
<i>Genyonemus lineatus</i>	white croaker	32,104,891	64.40	132.23			0.0037	39.4	13.5
Gobiidae unid.	gobies	16,188,141	35.38	13.88	15,452	13,272	0.0507	37.2	
<i>Sphyraena argentea</i>	Pacific barracuda	11,426,718	24.33	4.73			0.0036	9.2	2.7
<i>Seriphis politus</i>	queenfish	10,845,071	23.59	23.69			0.0006	35.9	9.7
<i>Paralichthys californicus</i>	California halibut	9,901,902	22.03	30.93	11	--	0.0026	32.9	8.2
<i>Hypsoblennius</i> spp.	combtooth blennies	8,324,912	21.42	24.05	4,757	20,302	0.0039	13.0	
<i>Citharichthys</i> spp.	sanddabs	6,752,119	13.54	27.84			0.0008	23.9	6.2
<i>Oxyjulis californica</i>	senorita	3,557,915	7.35	2.59			0.0056	29.5	
<i>Pleuronichthys ritteri</i>	spotted turbot	3,819,479	7.76	7.02			0.0010	26.3	6.9
<i>Pleuronichthys guttulatus</i>	diamond turbot	3,849,543	7.88	6.36			0.0094	37.0	
Atherinopsidae unid.	silversides	3,262,545	6.86	3.99			0.0304	26.1	
<i>Parophrys vetulus</i>	English sole	5,321,852	8.57	37.64	not calculated- single PE estimate				
EGGS									
Engraulidae unid.	anchovy eggs	236,042,601	574.02		1,949				
<i>Genyonemus lineatus</i>	white croaker eggs	34,295,926	94.05		19				
<i>Paralichthys californicus</i>	California halibut eggs	1,240,920	5.98		1				
INVERTEBRATES									
<i>Loligo opalescens</i>	market squid	3,367,525	7.67	2.96			not calculated- single PE estimate		
<i>Cancer</i> spp.	Cancer crabs	1,634,850	3.64	16.54			not calculated- single PE estimate		

¹- Two models used in extrapolating source water population: 1. alongshore extrapolation and 2. both alongshore and offshore extrapolation, shown by presence of one or both estimates.

El Segundo GS

Entrainment Analysis Results

Taxon	Common Name	Entrainment	Total Average	Total Average	Fecundity			Alongshore	Offshore	
			Total Estimated 2006	Average Entrainment Station Concentration (#/1000m³)	Source Water Station Concentration (#/1000m³)	Hindcast Estimate - Adult Females	Adult Equivalent Model Estimate	ETM Proportional Mortality Estimate (P_M) ¹	Distance (km) used in Source Water Extrapolation	Distance (km) used in Source Water Extrapolation
FISHES										
<i>Genyonemus lineatus</i>	white croaker	44,365,993	114.79	132.23				0.0029	39.4	13.5
<i>Engraulidae unid.</i>	anchovies	36,589,361	87.73	167.95	13,355	26,955		0.0018	54.6	21.7
<i>Sciaenidae unid.</i>	croakers	15,122,724	29.09	36.15				0.0042	28.5	7.4
<i>Paralabrax</i> spp.	sand bass	10,753,540	23.04	38.17				0.0033	21.9	
<i>Gobiidae unid.</i>	gobies	8,553,040	23.30	13.88	8,164	7,012		0.0150	37.2	
<i>Hypsoblennius</i> spp.	combtooth blennies	7,451,656	18.07	24.05	4,258	18,173		0.0028	13.0	
<i>Paralichthys californicus</i>	California halibut	6,869,726	14.46	30.93	8			0.0017	32.9	8.2
<i>Pleuronichthys guttulatus</i>	diamond turbot	2,148,380	12.28	6.36				0.0079	36.2	
<i>Citharichthys</i> spp.	sanddabs	4,476,374	10.47	27.84				0.0010	23.9	6.2
<i>Seriphis politus</i>	queenfish	5,807,906	10.72	23.69				0.0005	35.9	9.8
<i>Atherinopsidae unid.</i>	silversides	2,361,934	7.39	3.99				0.0178	26.1	
<i>Parophrys vetulus</i>	English sole	1,685,987	4.91	37.64				0.0008	29.8	7.6
EGGS										
<i>Engraulidae unid.</i>	anchovy eggs	432,212,026	1044.14		3,570					
<i>Genyonemus lineatus</i>	white croaker eggs	4,498,770	17.41		3					
<i>Paralichthys californicus</i>	California halibut eggs	602,696	2.25		< 1					
INVERTEBRATES										
<i>Cancer</i> spp.	Cancer crabs	1,860,530	4.16	16.54			not calculated- single PE estimate			

¹- Two models used in extrapolating source water population: 1. alongshore extrapolation and 2. both alongshore and offshore extrapolation, shown by presence of one or both estimates.

Redondo Beach GS

Entrainment Analysis Results

Taxon	Common Name	Total Estimated Entrainment 2006	Total Average Entrainment Station Concentration (#/1000m ³)	Total Average Source Water Station Concentration (#/1000m ³)	Fecundity Hindcast Estimate - Adult Females	Adult Equivalent Model Estimate	ETM Proportional Mortality Estimate (P_M) ¹	Alongshore Distance (km) used in Source Water Extrapolation
FISHES								
<i>Hypsoblennius</i> spp.	combtooth blennies	84,171,111	244.43	237.26	48,098	205,271	0.0718	2.0
Engraulidae unid.	anchovies	36,920,984	94.16	97.54	13,476	27,199	0.0084	17.7
<i>Genyonemus lineatus</i>	white croaker	16,106,308	64.49	82.10			0.0064	12.8
Gobiidae unid.	gobies	24,988,221	93.12	340.63	23,852	20,487	0.0507	10.5
<i>Hypsopops rubicundus</i>	garibaldi	21,038,500	90.02	14.73			0.0888	0.9
<i>Seriphis politus</i>	queenfish	5,866,626	20.72	6.94			0.0014	11.2
Sciaenidae unid.	croakers	4,516,673	16.49	15.09			0.0040	6.1
Labrisomidae unid.	labrisomid blennies	7,502,009	27.87	27.54			0.0578	7.1
<i>Typhlogobius californiensis</i>	blind goby	5,422,761	19.32	7.07			0.0946	2.2
<i>Gibbonsia</i> spp.	clinid kelpfishes	1,921,577	10.30	3.94			0.0460	12.1
Atherinopsidae unid.	silversides	2,520,629	10.62	6.80			0.0396	4.5
<i>Paralabrax</i> spp.	sand bass	1,726,638	7.95	7.73			0.0029	3.2
Gobiesocidae unid.	clingfishes	3,464,247	14.56	9.57			0.1178	12.7
<i>Paralichthys californicus</i>	California halibut	1,298,230	6.11	10.27	1		0.0016	6.5
EGGS								
Engraulidae unid.	anchovy eggs	412,719,987	941.64		3,409			
<i>Genyonemus lineatus</i>	white croaker eggs	881,875	10.25		< 1			
<i>Paralichthys californicus</i>	California halibut eggs	294,275	1.38		< 1			
INVERTEBRATES								
<i>Panulirus interruptus</i>	California spiny lobster	15,492,789	19.38	14.77				

¹ - Only alongshore currents used in extrapolating source water population due to primarily offshore transport for onshore-offshore currents.

Harbor GS

Entrainment Analysis Results

Taxon	Common Name	Total Estimated 2006 Entrainment	Total Average Entrainment Station Concentration (#/1000m ³)	Total Average Source Water Station Concentration (#/1000m ³)	Fecundity Hindcast Estimate - Adult Females	Adult Equivalent Model Estimate	ETM Proportional Mortality Estimate (P _M) ¹
FISHES							
Gobiidae unid.	gobies	33,282,698	515.98	201.89	43,360	36,231	0.0265
<i>Acanthogobius flavimanus</i>	yellowfin goby	15,407,999	263.17	23.26	968	--	0.0065
<i>Genyonemus lineatus</i>	white croaker	7,164,843	125.26	365.66			0.0019
<i>Lepidogobius lepidus</i>	bay goby	2,368,618	33.89	40.43			0.0024
<i>Hypsoblennius</i> spp.	combtooth blennies	2,255,907	29.63	207.42	1,413	6,024	0.0006
Sciaenidae unid.	croakers	995,438	19.36	29.70			0.0019
Engraulidae unid.	anchovies	940,784	13.97	54.12	5,746	10,998	0.0071
EGGS							
<i>Genyonemus lineatus</i>	white croaker eggs	17,867,461	281.18		10	--	
Engraulidae unid.	anchovy eggs	803,290	13.08		7	--	

¹- ETM model used a fixed source water volume in calculating PE estimates.

Alamitos GS

Entrainment Analysis Results

Taxon	Common Name	Total Estimated 2006 Entrainment ¹	Total Average Entrainment Station Concentration (#/1000m ³) ²	Total Average Source Water Station Concentration (#/1000m ³)	Fecundity Hindcast Estimate - Adult Females	Adult Equivalent Model Estimate	ETM Proportional Mortality Estimate (P _M) ³	Alongshore Distance (km) used in Source Water Extrapolation	Offshore Distance (km) used in Source Water Extrapolation
FISHES									
Gobiidae unid.	gobies	1,065,638,741	1,542.48	1,071.51	1,146,022	974,076	0.1332	26.9	
<i>Hypsoblennius</i> spp.	combtooth blennies	463,862,356	554.46	369.87	264,876	1,130,436	0.0899		9.6
Atherinopsidae unid.	silversides	56,032,917	84.60	17.84			0.0839	22.9	
Engraulidae unid.	anchovies	21,410,241	20.41	168.79	3,973	8,059	0.0071	27.0	24.4
EGGS									
Engraulidae unid.	anchovy eggs	23,367,964	22.34		207				
<i>Genyonemus lineatus</i>	white croaker eggs	1,581,315	4.92		1				

¹- Estimate based on sum from entrainment samples collected at Units 1-4 intake canal and Units 5-6 intake canal.

²- Estimate based on mean of entrainment stations

³- Two models used in extrapolating source water population: 1. alongshore extrapolation and 2. both alongshore and offshore extrapolation, shown by presence of one or both estimates.

Haynes GS

Entrainment Analysis Results

Taxon	Common Name	Total Estimated Entrainment	Total Average Entrainment Station Concentration (#/1000m ³)	Total Average Source Water Station Concentration (#/1000m ³)	Fecundity Hindcast Estimate - Adult Females	Adult Equivalent Model Estimate	ETM Proportional Mortality Estimate (P _M) ¹	Alongshore Distance (km) used in Source Water Extrapolation	Offshore Distance (km) used in Source Water Extrapolation
FISHES									
Gobiidae unid.	gobies	1,823,656,891	1,661.02	1,071.51	1,966,281	1,671,266	0.2515	26.88	
Atherinopsidae unid.	silversides	920,323,104	778.19	17.84			0.4095	22.88	
<i>Hypsoblennius</i> spp.	combtooth blennies	733,696,243	652.36	369.87	418,001	1,783,945	0.1389	9.61	
<i>Genyonemus lineatus</i>	white croaker	75,425,299	67.68	450.11			0.0063	26.19	23.66
Engraulidae unid.	anchovies	22,673,541	19.54	168.79	4,208	8,535	0.0076	27.02	24.43
EGGS									
<i>Genyonemus lineatus</i>	white croaker eggs	57,836,910	63.01		32				
Engraulidae unid.	anchovy eggs	11,128,912	10.03		92				

¹- Two models used in extrapolating source water population: 1. alongshore extrapolation and 2. both alongshore and offshore extrapolation, shown by presence of one or both estimates.